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Constraints Encountered by Farmers Engaged in Shrimp Cultivation in Punjab

Iranshu Mittal and H K Mavi
Department of Economics and Sociology
Punjab Agricultural University, Ludhiana, 141004, (Punjab), India

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ABSTRACT

In the south-western region of Punjab, shrimp farming is helping in transforming the land which was once unsuitable for farming and growing crops due to waterlogged and saline conditions. However, while shrimp farming presents a favourable prospect for income diversification, yet shrimp farmers has to face various constraints. The objective of this study is to explore the main constraints faced in shrimp production, marketing and financing. The study was carried out in Muktsar and Fazilka districts of south-western region of Punjab in the year 2023-2024. Forty farmers were selected using probability proportional to size sampling categorized in small, medium and large on the basis of area under shrimp farming was taken to study their perceptions using a 5-point Likert scale with an aim to analyse the seriousness of the constraints. The study found out that the highest cost of feed was the main constraint with Likert scale value 4.88 followed by electricity cost (4.83), shrimp seed cost (4.25) and disease outbreaks (4.20). Small farmers faced the highest feed cost (4.96) whereas large farmers reported electricity cost (5.00). While in marketing constraint, price fluctuation and uncertainty of prices scored 5.00 in Likert scale followed by lack of storage facility (3.83) and access to price information (3.68) were reported by shrimp farmers. In financial constraints, small farmers reported about the lack of institutional credit (1.98) followed by high interest rate from non-institutional credit (1.20) as major issues. The study recommends policies that provide access to quality seed and affordable feed, improve disease control, offer technical training, upgrade storage and market access, and ensure easier access to fair credit.

Keywords: Constraints, Likert scale, Punjab, Shrimp.

INTRODUCTION

India stands third largest in fish production and the second largest in aquaculture production after China in the world (FAO, 2022). This can only be possible with the help of blue revolution initiative by Government of India, whose main focus was to encourage sustainable farming techniques, improves infrastructure, and growth in fish production, it was possible to achieve (Government of India, 2023). One significant change is the transition from marine to inland fisheries, which now account for about 70% of India's total fish production, compared to 36% in the 1980s (CIFE, 2020). Controlled inland aquaculture promotes environmental sustainability and provides more effective resource management. In India, various river systems, lakes, brackish water areas provide a plenty of aquatic resources. Still there is a major extent of India's aquaculture potential remains untouched (Government of India, 2023). Brackish water shrimp farming production has grown from 20 metric tonnes in 1970 to 747,000 metric tonnes by 2020 shows its potential in production (FAO, 2022). Out of the 1.42 million hectares area, only 13% could be currently utilized for this type of farming. To address this issue, Government of India targets to increase production to 1.1 million metric tonnes and double productivity by the year 2024-2025 (Government of India, 2023). To accomplish sustainable growth, adoption of better farming practices, investment in infrastructure, and placing biosecurity measures into place are all essential (World Bank, 2021).

In the south-western parts of the Punjab state in India, saline and waterlogged fields that were previously unsuitable for growing crops are now being used for shrimp (*Penaeus vannamei*) farming. Institutes like CIFE and GADVASU, which helped run a pilot project in collaboration with the Government of Punjab, have come out with positive results (Singh *et al,* 2020). In Punjab, the area under shrimp farming has increased, *i.e.,* from 392 acres to 1,200 acres by the year 2020, with an aim to increase the production of shrimp annually to over 104,000 metric tonnes by the year 2025 (Government of Punjab, 2025). In India, farmed shrimp farming is a rapidly growing aquaculture sector

Corresponding Author's Email - mavihk05@pau.edu

Table 1. Socio-economic status of sampled shrimp farmers (2023-2024).

Sr. No.	Particular	Small (n_1 = 24)		Medium (n_2 = 11)		Large (n_3 = 5)		Overall (N = 40)	
		No.	%	No.	%	No.	%	No.	%
A.	Education Level								
1.	Illiterate	2	8.33	-	-	-	-	2	5.00
2.	Up to Primary	-	-	-	-	-	-	-	-
3.	Up to Middle	1	4.17	1	9.09	-	-	2	5.00
4.	Matriculate	4	16.67	1	9.09	1	20.00	6	15.00
5.	Senior Secondary	10	41.67	5	45.45	2	40.00	17	42.50
6.	Graduate and Above	7	29.17	4	36.36	2	40.00	13	32.50
B.	Family Type								
7.	Nuclear	20	83.33	9	81.82	4	80.00	33	82.50
8.	Joint	4	16.67	2	18.18	1	20.00	7	17.50
9.	Total	24	100.00	11	100.00	5	100.00	40	100.00
C.	Family Size (Members)								
10.	<5	17	70.83	4	36.36	3	60	24	60.00
11.	5 to 6	2	8.34	7	63.64	1	20	10	25.00
12.	>6	5	20.83	-	-	1	20	6	15.00
13.	Average Family Size	4.70	-	4.91	-	5.00	-	4.80	-
D.	Experience (Years)								
14.	Less than 3 (<3)	3	12.50	1	9.09	0	0.00	4	10.00
15.	03-05	18	75.00	7	63.64	3	60.00	28	70.00
16.	More than 5 (>5)	3	12.50	3	27.27	2	40.00	8	20.00
E.	Occupation								
17.	Aquaculture	2	8.33	2	18.18	1	20.00	5	12.50
18.	Aquaculture + Agriculture	17	70.83	6	54.55	2	40.00	25	62.50
19.	Aquaculture + Business/Job	5	20.83	3	27.27	2	40.00	10	25.00

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and India is the fifth-largest producer of farmed shrimp worldwide. Though West Bengal contributes significantly to shrimp production in India, Punjab also offers likely prospects for this sector. The shrimp farmers faced many constraints related to finance, marketing, and the production of shrimp. Problems as feed cost, disease occurrences, market price fluctuations, and inadequate credit accessibility make shrimp production difficult. Understanding these constraints and finding farmer-centred solutions are crucial to ensure sustainable production by increasing the overall profitability of shrimp farming. The purpose of this study is to examine the different limitations that shrimp farmers perceive.

MATERIALS AND METHODS

Using a systematic approach, a thorough field survey was carried out to determine the challenges shrimp farmers face in Punjab. A list of shrimp farmers was gathered from the State Fisheries Department and because of higher area under shrimp farming; Muktsar and Fazilka were chosen as the study's focal districts. From each selected district, two blocks were selected based on farmer's availability, and village clusters were recognized. To ensure representativeness of the shrimp farmers, 40 were selected (20 shrimp farmers from each district) by using a probability proportional to size sampling technique. To measure the constraints among different operational sizes, the study categorized

Table 2. Constraints faced by shrimp farmers in production, 2023-2024.

Sr. No.	Production Constraint	Mean Score				Ranking
		Small	Medium	Large	Overall	
1.	High cost of feed	4.96	4.82	4.60	4.88	I
2.	High cost of electricity	4.79	4.82	5.00	4.83	II
3.	High price of seed	4.33	4.00	4.40	4.25	III
4.	Prevalence of disease outbreak	4.13	4.36	4.20	4.20	IV
5.	Lack of good quality seed	4.00	4.45	4.20	4.15	V
6.	Inadequate technical experts	3.75	3.73	4.40	3.83	VI
7.	Sudden fall in DO due to power failure	3.50	3.45	3.40	3.48	VII
8.	Lack of scientific knowledge	3.21	3.64	3.80	3.40	VIII
9.	Partial damages during harvesting	3.29	2.36	4.60	3.20	IX
10.	Non availability of skilled labour	3.13	2.55	4.80	3.18	X
11.	Over dosage of chemicals	1.42	1.45	1.20	1.40	XI
12.	Poor water quality	1.08	1.09	1.40	1.13	XII
13.	Shortage of water	1.08	1.09	1.00	1.08	XIII

Table 3. Constraints faced by shrimp farmers in shrimp marketing, 2023-2024

Sr. No.	Marketing Constraint	Mean Score				Ranking
		Small	Medium	Large	Overall	
1.	High fluctuation in price	5.00	5.00	5.00	5.00	I
2.	Lack of storage facility	3.83	3.82	4.00	3.83	II
3.	Lack of price information	3.79	3.36	3.60	3.68	III
4.	Problem in weighing	1.67	2.73	3.20	2.10	IV
5.	No alternative Channel	1.58	1.55	2.00	1.68	V
6.	Problem of direct selling	1.29	1.64	2.00	1.48	VI
7.	Delayed payment	1.00	1.00	1.00	1.00	VII

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farmers into three groups based on the area under shrimp farming, *i.e.,* small (less than 5.7 acres), medium (5.7-11.05 acres), and large (more than 11.05 acres). The study was carried out in the 2023-2024 production years, in order to gather the perceptions from the farmers. To collect the data and correct information, selected farmers were personally interviewed by using a well-structured schedule. A 5-point Likert scale was used to rate farmer's perceptions and difficulties, giving their answers numerical scores. A survey was used to gather data, and each constraint mean score was determined to enable a ranking of the perceived severity of each constraint.

RESULTS AND DISCUSSION

Before analysing the challenges faced by shrimp farmers, it is crucial to first examine the various socio-economic characteristics of the sampled shrimp farmers. The socioeconomics characteristics of the samples shrimp farmers are presented in the table 1. Over half of the sampled farmers (55%) are ranged between the ages of 41 and 50 represents that the experienced farmers are involved in shrimp farming. About 37.50% of the sampled farmers were between the ages of 31 and 40, showing young and active members in shrimp farming. Farmers over the age of 50 make up just 5 percent, and those under 30 accounts for only 2.50 percent, showing that shrimp farming is not widely pursued by the youngest or oldest demographics. On an average, shrimp farmers are around 41.40 years old, with small farmers averaging 40.67 years, medium farmers at 42.18 years, and large farmers slightly older at 43.20 years. About 42.50 per cent of shrimp farmers have completed senior secondary education. Additionally, 32.50% of the sampled farmers have graduation or advanced degree showing extremely educated personnel. Only 15% of the sampled farmers have matriculated, and five per cent have completed middle school and another five per cent were illiterate. There are no farmers with an education level limited to primary or below. Out of the 40 households surveyed, 82.50 percent are nuclear families, and 17.50 percent are joint families, underscoring the dominance of the nuclear family structure among shrimp farming households in the region. Around 60 percent of households consist of family less than 5 members, 25 percent have family 5

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to 6 members, and 15 percent include more than 6 family members. The average family size across all households is 4.80, with small families averaging 4.70, medium families 4.91, and large families 5.00. The majority of shrimp farm operators (70.00 per cent) fall within the 3 to 5 years of experience category. A smaller group (20.00 percent) have more than 5 years of experience, and only 4 operators (10.00 percent) have less than 3 years of experience. This distribution indicates that most shrimp farm operators in Punjab have moderate experience, with fewer being either novices or highly experienced professionals. The majority of shrimp growers (62.50 percent) combine aquaculture with agriculture, reflecting the predominant practice across all farm sizes. A smaller group (25 percent) engage in aquaculture combined with business or a job, while only 5 growers (12.50 percent) are exclusively dedicated to aquaculture. This indicates that most shrimp farm operators diversify their occupations, with aquaculture often supplemented by agricultural activities. The same trend was also noticed by Vadher and Kapila (2014).

Shrimp farmers in Punjab have to face a number of constraints like finance, marketing, and production. To analyse these constraints a 5-point Likert scale was used and average scores were calculated which shows about the severity of the constraint. Shrimp farmers in Punjab have to tackle with various production-related challenges that hinder their business operations and productivity (Table 2). The main causes of the sharp increase in production costs are the high cost of feed and electricity. Farmers are further burdened by the high cost of shrimp seed and the scarcity of high-quality seed. Inadequate access to technical experts for prompt guidance exacerbates the on-going threat of disease outbreaks. Sudden Power cuts causes drop in the dissolved oxygen (DO) levels of the water resulted in stress or kill shrimp stocks. Lack of scientific knowledge and skilled labour caused hindrance in harvesting operations. The sampled farmers also have to face the issues *viz.,* water scarcity and poor water quality so as to sustain optimal farming conditions for shrimp production (Rani *et al,* 1993). The biggest obstacle for small-scale shrimp farmers was the high cost of feed (Likert score: 4.96). High seed prices (4.33) and high electricity costs (4.79) were other important problems. Notable constraint included disease outbreaks (4.13) and a shortage of high-quality seed (4.00). High feed and electricity costs (4.82 each) were also cited as major concerns by medium-sized farmers. High priorities also included the absence of high-quality seed (4.45) and disease outbreaks (4.36). High feed costs (4.60) and high electricity costs (5.00) were the top concerns of large-scale farmers. For this group, the lack of high-quality seed (4.20) and the high cost of seed (4.40) were also significant issues. The two biggest issues across all farm sizes were the high cost of feed (4.88) and electricity (4.83). This is followed by the high cost of seed (4.25) and the frequency of disease outbreaks (4.20). These results are consistent with other research (Sayed *et al,* 2013; Tandel and Meheta, 2018) showing that inadequate disease control procedures and growing feed and seed expenses are major constraint in Indian aquaculture.

The shrimp farmers in Punjab face various marketing constraints causing limited access to markets either local or distant resulting in limited earnings. Shrimp price instability is a major issue that effects income stability and causes uncertainty. Due to lack of access to timely and accurate shrimp prices information, farmers cannot make their selling decisions. Due to a lack of adequate storage facilities, shrimp farmers have to go for forced sales at low prices. As shrimp farmers are unable to sell directly, they have to rely on middlemen who keep a significant amount of the profits (Chittem and Kunda, 2017). Their financial burden is increased when payments are delayed. The marketing challenges Punjab shrimp farmers faced in 2023–2024 are listed in Table 3. With a perfect score of 5.00, high price fluctuation was consistently rated as the biggest marketing challenge for farms of all sizes. Two other significant shared concerns were the absence of storage facilities (Likert score 3.83) and price information (Likert score 3.68). These results are consistent with other research that found price volatility and problems with market access to be significant constraint in the shrimp farming industry. Another important constraint for shrimp farmers in Punjab is the financial constraint. Among all farm categories, cross all farm sizes, collateral security of institutional loan got the lowest score (Likert score 1.00). For small shrimp farmers, high non-institutional credit interest rates put worse financial strain (Likert score 1.20). Inadequate credit support (Likert score 1.98) from banks hampers shrimp farmers' capacity to invest in better infrastructure or technology. Although having comparatively less severe financial constraints, large sampled farmers still face these general issues, also reported by Jagadeesh in the year 2015. There is potential of shrimp farming in the south-western region of Punjab, but due to production, marketing, and financial constraints, the shrimp farmers are facing uncertainties. The major production constraints among all shrimp farm categories recorded was high input costs on feed (Likert score: 4.88) and electricity

(Likert score: 4.83) followed by disease outbreak in shrimps (Likert mean score: 4.20) and high price of shrimp seed (Likert score: 4.25) resulted in declining operational efficiency. Another constraint for small sampled farmers includes sudden and frequent power cuts that effect dissolved oxygen levels. Large and medium category farmers also faced the need for skilled workers and labour shortage. The same findings were identified by Patil and Sharma (2021). One major marketing constraint is price volatility (Likert score: 5.00) followed by inadequate storage facilities (Likert score: 3.83) and limited access to timely price information (Likert score: 3.68) affect the decision-making and profitability of the shrimp farmers. Financial constraints are constantly significant, particularly for high non-institutional credit interest rates and institutional loan collateral security.

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CONCLUSION

Despite its optimistic outlook, Punjab's shrimp farming industry faces several constraints that result in significant financial losses. The major constraints mentioned are high input costs (feed and electricity), price volatility and challenges in finding low-interest-rate credit. The unavailability of high-quality shrimp seed, disease outbreaks, and difficulty in accessing technical assistance affect the shrimp farming. These constraints need to be addressed in order to keep shrimp farming viable in Punjab. To address these constraints, targeted intervention is required. The main focus of policy implications are as follows:

High-quality inputs access

In order to lower disease outbreak and improve survival rate, government should set up hatcheries which can provide subsidized premium shrimp seeds. Alike agriculture, feed and electricity tariff subsidies, would help in reduction of operational costs. Feed production facilities should be established within the state which can further reduce costs. Research should be done on developing disease-resistant shrimp breeds, establishing diagnostic labs, disease surveillance systems, and immunization programs for better shrimp production.

Training and technical assistance

There is a need to organise regular workshops and training sessions to improve farmers' scientific knowledge and lessen the skilled labour shortage. By employing graduates, farmers can get technical assistance to lower risks and apply best practices.

Strengthen market systems

To save farmers from uncertain markets and fluctuating prices, there is a need to establish price stabilization or cooperative purchasing programs. Farmers will have more bargaining power and income if they can get accurate and timely market information. For this purpose, the government should promote digital platforms and digital apps for real-time market information, like prices and demand trends. To stop distress or forced sale and reduce post-harvest losses, infrastructure like cold storage needs to be upgraded.

Credit availability

To ensure credit access by farmers at affordable interest rates, policies like subsidized credit, collateral-free loan programs, and improved financial literacy are necessary. By executing these policy initiatives, Punjab can fully utilize the potential of its shrimp farming industry, ensuring sustainable practices and increased profitability for shrimp growers and other stakeholders.

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